SOCIOECONOMICS APPENDIX

SOCIOLOGY

TABLE 59
POPULATION OF COUNTIES AND COMMUNITIES IN THE STUDY AREA
(1940-1990)

County/Community	1940	1950	1960	1970	1980	1990	Percent of Change 1980-1990
Daniels	4,563	3,946	3,755	3,083	2,835	2,266	-20
Flaxville	—	—	—	185	142	88	-38
Scobey*	—	—	—	1,486	1,382	1,382	-17
Dawson	8,618	9,092	12,314	11,269	11,805	9,505	-20
Glendive*	—	—	—	6,305	5,978	4,802	-20
Richey	—	—	—	389	417	259	-38
Fallon	3,719	3,360	3,997	4,050	3,763	3,103	-18
Baker*	—	—	—	2,584	2,354	1,818	-23
Plevna	—	—	—	189	191	140	-27
Garfield	2,641	2,172	1,981	1,796	1,656	1,589	- 4
Jordan*	—	—	—	529	485	494	2
McCone	3,798	3,258	3,321	2,875	2,702	2,276	-16
Circle*	—	—	—	964	931	805	-14
Prairie	2,410	2,377	2,318	1,752	1,836	1,383	-25
Terry*	—	—	—	870	929	659	-29
Richland	10,209	10,366	10,504	9,837	12,243	10,716	-13
Fairview	—	—	—	956	1,366	869	-36
Sidney*	—	—	—	4,543	5,726	5,217	- 9
Roosevelt	9,806	9,580	11,731	10,365	10,467	10,999	5
Bainville	—	—	—	217	245	165	-33
Brockton	—	—	—	401	374	365	- 2
Culbertson	—	—	—	821	887	796	-10
Froid	—	—	—	330	323	195	-40
Poplar	—	—	—	1,389	995	881	-12
Wolf Point*	—	—	—	3,095	3,074	2,880	- 6
Sheridan	7,814	6,674	6,458	5,779	5,414	4,732	-13
Medicine Lake	—	—	—	393	408	357	-13
Outlook	—	—	—	153	122	109	-11
Plentywood*	—	—	—	2,381	2,476	2,136	-14
Westby	—	—	—	287	291	253	-13
Wibaux	2,161	1,907	1,698	1,465	1,476	1,191	-19
Wibaux*	—	—	—	644	782	628	-20
Total	55,739	53,032	58,077	52,271	54,197	47,760	-12

SOURCE: State of Montana, Department of Commerce 1991.
NOTE: *indicates community is a county seat.

TABLE 60
OBJECTIVE INDICATORS OF SOCIAL WELL-BEING IN THE STUDY AREA

		Daniels	Dawson	Fallon	Garfield	McCone	Prairie	Richland	Roosevelt	Sheridan	Wibaux	Montana	U.S.
Physicians (nonFederal per 10,000 population 1980)		7.1	5.1	8.0	6.0	3.7	0.0	8.2	5.7	3.7	0.0	12.7	17.4
Education levels - percent population completing at least 4 yr high school 1980		66.1	71.3	63.7	72.9	69.5	59.5	66.6	68.4	67.7	60.1	74.4	66.5
Percent housing lacking some or all plumbing facilities in 1980		3.0	1.9	1.5	2.9	2.8	2.8	1.9	2.3	2.0	1.8	2.3	2.2
Per capita personal income 1986		$15,800	$12,600	$12,700	$14,400	$12,900	$12,000	$11,800	$10,500	$14,300	$11,400	$12,400	NA
Median family income 1979		$16,106	$19,621	$18,329	$13,480	$14,295	$10,724	$19,865	$16,622	$17,270	$13,784	$18,413	$19,917
Percent families below the poverty level 1979		10.6	6.8	13.4	19.3	19.3	27.7	7.5	11.2	11.2	18.0	9.2	9.6
Percent population in the working age group (18-64) 1980		55.8	59.4	57.5	59.0	55.8	53.1	58.4	55.5	57.8	53.9	59.8	60.6
Percent net migration 1980-1988		-10.3	-23.2	-20.1	-10.3	-13.8	-15.0	-15.7	-7.3	-8.4	-18.7	-5.0	NA
Persons per square mile 1988		.8	4.3	2.0	0.4	1.0	0.9	5.7	4.7	3.1	1.5	2.4	NA
Unemployment rate 1987		4.6	6.1	7.2	3.4	2.8	5.6	9.1	8.8	4.8	5.4	7.4	NA
Crime rate per 10,000 population (major crimes) 1987		77.5	83.4	71.9	NA	12.1	NA	248.0	307.4	195.7	62.0	400.3	NA
Marital termination rate (per 1,000 population) 1987		2.3	4.4	3.1	0.0	1.2	1.2	4.5	3.6	5.8	0.8	5.1	NA
Change in number of farms 1982-1987		1.0%	0%	14%	13%	4%	4%	12%	2%	2%	4%	4%	NA
Change in land in farms 1982-1987		-5%	-2%	4%	-2%	-1%	-2%	10%	-1%	-2%	10%	-1%	NA
Changes in average size farm 1982-1987		-5%	-2%	-9%	-13%	-4%	-6%	-1%	-3%	-5%	5%	>.05%	NA
Percent 1987 farms/farmland in nonfamily corporations or other	Farms	1%	1%	>.5%	1%	1%	1%	2%	1%	1%	0%	1%	NA
	Farmland	3%	NA	NA	NA	NA	NA	3%	18%	NA	0%	9%	NA

SOURCE: State of Montana, Department of Commerce 1988; Department of Justice 1989; Department of Health and Environmental Sciences 1987. U.S. Department of Commerce, Bureau of Census 1987.

Big Dry Resource Management Plan and Environmental Impact Statement Interviews

During March and April of 1991, BLM employees held telephone discussions with 102 study area residents and other interested people such as leaders of groups oriented toward recreation, resource protection, and agriculture. Study area government officials such as county commissioners, planners and mayors were also contacted in study area communities. Efforts were made to contact a variety of people representing agriculture, recreation, business and resource protection interests. The discussions covered familiarity with BLM lands and management, changes and problems observed on BLM lands, recreation behaviors, community perceptions and concerns, and preferences for BLM management. Because participants were not randomly chosen, the data must be interpreted cautiously but it can be used to give an indication of how local residents and other concerned individuals view their communities and the decisions made by BLM.

Social Impact Assessment

The only social impacts from this resource management plan and environmental impact statement would be changes in social well-being except for the impacts from coal development. Discussions with area residents and other interested individuals indicated concern with local economic development, preserving the agricultural way of life, provision of recreation opportunities, and protection of the natural resources on which the area depends. Preserving the agricultural way of life is important because of the unique lifestyle it offers and because local communities are economically dependent on agriculture.

BLM resource decisions could affect social well-being in a variety of ways. These include changes in the amount and quality of resources such as recreational opportunities and livestock grazing, and resolution of problems related to resource use, such as access problems. BLM's decisions could affect the ability to earn a living from a resource due to changes in the amount and quality of the resource, which could in turn affect the standard of living and therefore, social well-being.

Other intangible beliefs that could affect social well-being include individuals having a sense of control over the decisions that affect their future, and feeling that the government strives to act in ways that benefits everyone equitably, rather than benefitting just a privileged few.

ECONOMICS

Assumptions and Method of Analysis

The economic analysis used in the resource management plan and environmental impact statement is based on the ability of the resource specialists to identify and quantify changes in resource outputs that result from the implementation of the numerous management actions across the alternatives. The basis for comparison was the existing situation, rather than a baseline projection. The changes in outputs were converted to l990 dollar values and the analysis was based on the gross output, earnings, and employment multipliers developed by the Bureau of Economic Analysis (U.S. Department of Commerce, BEA 1991) in the Regional Input-Output Modeling System for a 39-sector Montana economy. The multipliers used in the analysis are shown in table 61.

TABLE 61
OUTPUT, EARNINGS AND EMPLOYMENT MULTIPLIERS

Sector	Output[1]	Earnings[2]	Employment[3]
Agriculture	2.481	0.4943	30.7
Oil and Gas	1.3826	0.2070	10.2
Construction	1.9199	0.6267	35.3
Recreation[4]	1.7802	0.6407	57.15

SOURCE: U.S. Department of Commerce, BEA 1991.

[1]Total dollar change for each additional dollar of output delivered by the impacted sector.

[2]Total dollar change in earnings of households employed by all sectors for each additional dollar of output delivered to the impacted sector.

[3]Total changes in number of jobs in all sectors for each additional l million dollars of output delivered to the impacted sector.

[4]The recreation multipliers were calculated using a weighted average of the following economic sectors: .5 retail trade + .25 lodging + .25 eating and drinking places.

The following describe the assumptions and methodology used to quantify and value the units of outputs identified by the various resource specialists.

COAL

The type and magnitude of social impacts from coal are based on the ability of the community to adapt to change and the change itself (USDI, BLM 1982d). In general, communities that have a large diverse population base, experience with development, ties to outside organizations, a diverse labor force, adequate services and facilities, experienced leadership and a positive attitude toward growth will be able to deal with population growth. Small communities with no historical experience with development, few linkages to nonlocal organizations, a fairly uniform population, an inadequate service base, and inexperienced leadership are more likely to have problems dealing with population growth.

Social impacts may include changes to social organization and social well-being. Social organization refers to the way in which the people in the community relate to each other. Social well-being refers to the way individuals feel about their community and the quality of life that it offers. The following paragraphs describe the types of changes that could occur to community social organization and social well-being in an energy growth scenario, as described in the Minerals appendix. These generic impacts are based on discussions in the Guide to Social Assessment (USDI, BLM 1982d) and the North Dakota Resource Management Plan (USDI, BLM 1986a).

Potential changes in social organization include residents no longer knowing everyone, greater diversity in resident lifestyles, changes in business transactions and government structures from casual to more formalized, increases in the level of outside influences in the community, and erosion of the traditional community power bases. These changes could be permanent, substantial, and intense. In extreme cases, change might be so great that long-term residents would feel like strangers in their own community. The severity of these impacts would depend on the predevelopment social organization of the community (i.e., whether the community is a relatively informal agricultural area or whether it has become more formal and urbanized) and the size and character of incoming populations. Change would be greatest in situations where the predevelopment community social organization was very informal, the population influx was large, and the types of in-migrants were different than current residents.

Impacts to social well-being depend upon the pre-existing level of community social well-being and the size and type of the incoming population. Negative impacts to social well-being would be greatest in situations where predevelopment services and infrastructure were inadequate, the town is small relative to the population increase, and the types of in-migrants are different than the current residents. These impacts may be mostly of a short-term nature, noticeable primarily during periods of peak construction.

Beneficial changes in social well-being would accrue to those people who were able to acquire employment or who benefitted from business expansion as a result of the increased income in the community. The availability of local employment may allow some younger people to remain in their communities to work if they desire, reversing youth out-migration trends which currently characterize many rural areas.

The increase in income which would accompany the increase in employment could enhance the well-being and possibly raise the standard of living of those positively affected. It could also create disparity in groups or between individuals who did not benefit.

Population growth would cause increased demand for public and private services of all types. In some cases the capacity of towns to respond would be overwhelmed, especially if services were currently inadequate or providers were not used to handling the types of problems which they would encounter. This strain on services would reduce the availability or distribution of resources to long-time users and newcomers alike.

An increase in the number of strangers passing through town, noise, crowds, traffic, and other stresses would also occur. These disturbances could be particularly distressing for those residents who never had to deal with such problems before. Although people would likely adapt to these changes, which would be most intense during peak construction phases, they might regret the loss of the quiet, slow-paced small town atmosphere they previously enjoyed.

Some area ranchers and farmers may object to the changes if coal development occurs. In smaller communities, differences in wages and possibly a change in politics caused by population growth could leave ranchers and farmers feeling separated from the community. These generic impacts are based on discussions in the Guide to Social Assessment (USDI, BLM 1982d) and the North Dakota Resource Management Plan (USDI, BLM, 1986a).

Some area ranchers and farmers have organized in opposition to development because of their concern over regional impacts to air and water resources which they feel could affect their economic and social welfare and ultimately limit their future options. These agricultural producers are not convinced that the coal in the Big Dry Resource Area is needed to meet national energy goals or that the successful reclamation of agricultural land can be guaranteed.

Because of regionwide impacts to service and facility provision, Native Americans may find themselves negatively impacted if they travel off the reservation for shopping, medical services, etc. The increased traffic, crowded conditions, and other stressful situations they could encounter could make such trips unpleasant. These conditions would be most noticeable during the peak construction periods.

Positive impacts to social well-being would be most apparent if Native Americans were able to acquire employment on energy projects. With increased employment opportunities, Native Americans who have had to leave the reservation to look for work may find they are able to stay in the area.

Coal mine and facility development would eventually help to diversify the economy of eastern Montana. Expansion, due to new energy growth, would result in a change from an agricultural to a construction-trade oriented economy. At the community level this would translate into a broader range of goods and services being offered and greater employment opportunities; however, in the short run, public service costs associated with energy growth might well exceed base tax revenues.

Short-term, energy-related impacts may have an adverse effect on baseline municipal services in some of the communities identified. Adequate planning and management capabilities are essential in developing mitigation strategies. The lack of planning may result in fiscal problems, inadequate or excessive investment in community infrastructure, and a decrease in the quality of life.

There appear to be five critical factors that must be present to mitigate some of the adverse economic or social impacts that could result from rapid energy growth. These factors are: accurate information, adequate lead time, planning expertise, adequate financial resources, and political leadership. If any of these five factors are missing, it is likely that a community will not be able to ease the adverse effects of energy related growth. These factors are discussed in detail in the Fort Union Coal Region Draft Environmental Impact Statement (USDI, BLM 1982c).

Direct employment would peak at approximately 1,550 people during the third year of the project (see table 62). Long-term operation employment would total approximately 450. Direct annual payroll would peak at approximately $61 million in the third year of construction (see table 63). Payroll during the operation phase would total

TABLE 62
MINE AND COAL-FIRED ELECTRIC POWER GENERATION PLANT

Construction and Operation Work Force Requirements
1990-2000[1]

		Total		Mine		Plant	
Year	Construction & Operation	Construction	Operation	Construction	Operation	Construction	Operation
1	500	450	50	150	50	300	0
2	1,300	1,200	100	50	100	1,150	0
3	1,550	1,400	150	150	150	1,250	0
4	1,100	850	250	50	200	800	50
5	1,000	650	350	0	250	650	100
6	950	600	350	0	250	600	100
7	1,050	700	350	0	250	700	100
8	600	150	450	0	250	150	200
9	450	0	450	0	250	0	200
10-40	450	0	450	0	250	0	200

SOURCE: USDI, BLM 1978; 1981a.

[1]Assumming a 4-year construction period for the mine and 8 years for the facility with periods overlapping. Numbers rounded to the nearest 50.

about $19 million annually for the life of the project.

Indirect employment would peak at about 900 and decrease to 700 in the operations phase (see table 64). Payroll to indirect workers (in 1990 dollars) would peak at approximately $15.5 million and decrease to $12 million in the long run.

TABLE 63
DIRECT PERSONAL INCOME GENERATED BY THE MINE AND FACILITY (Thousands of 1990 Dollars)

Year	Direct Construction Income	Direct Operations Income	Total Direct Income
1	17,453	2,256	19,709
2	46,541	4,513	51,054
3	54,298	6,768	61,066
4	32,967	11,069	44,036
5	25,210	15,371	40,582
6	23,271	15,371	38,642
7	27,150	15,371	42,521
8	5,817	19,462	25,278
9	0	19,462	19,462
10-40	0	19,462	19,462

SOURCE: North Dakota Labor Market Advisor 1975.

TABLE 64
INDIRECT EMPLOYMENT AND INCOME FOR THE MINE AND FACILITY

Year	Number of[1] Indirect Employees	Indirect[2] Employees (Payroll)
1	300	5,180
2	750	12,950
3	900	15,540
4	800	13,814
5	850	14,677
6	800	13,814
7	900	15,540
8	750	12,950
9	700	12,087
10-40	700	12,087

SOURCE: North Dakota Labor Market Advisor 1975.

NOTE: See Table 66 for an explanation of how these figures were calculated.

[1]Employment is rounded to the nearest 50.
[2]Figures are in thousands of 1990 dollars.

The proportion of workers hired locally depends upon a variety of factors including community size, the distance between the project and the communities, the size of the project, the presence of other projects in the area, the number of unemployed or underemployed workers in the area, skill types available, and area wage levels (Weiland et al. 1977). Local workers may be willing to commute as far a 60 miles or more for temporary construction work (Murdock and Leistritz 1979). The figures used in this analysis to determine the proportion of local workers hired have been taken from studies of existing mine and facility work forces.

Local hires would peak at about 1,400 during construction (see table 65). Long-term local hires would total approximately 700 and most would be engaged in employment indirectly related to the mine and facility. Total population in-migration would peak at approximately 2,050 during the third year (see table 66). This figure would decline to about 1,100 during the long-term operation of the project.

The population size of existing communities and the distance between the project and communities are major determining factors for where people settle. Population size is important because it is closely associated with the service structure of communities; different size cities generally can support different levels and types of community services. In previous studies of similar developments, areas over 30 miles from the project appeared to be relatively unattractive to in-migrants. Construction workers hired for a fixed duration of time were more likely to commute longer distances than those hired for the lifetime of the project (Murdock and Leistritz 1979).

The impact of in-migrating population on services and infrastructure cannot be analyzed in detail, because site specific development proposals are necessary before service and infrastructure analysis becomes meaningful. The distribution and type of incoming population and the current community service and infrastructure capacity are both critical in determining how in-migrants affect services and infrastructure.

During the initial construction period of large-scale energy projects, considerable stress may be placed on local services and infrastructures such as housing, schools, police, sewage, etc. Unless specific plans are made to avoid the situation (see mitigation discussion), there is a lag period between the time the service and infrastructure demands increase and when monies such as coal conversion and coal severance taxes are available to deal with the increased demand.

Those communities that experience significant long-term fiscal deficits could have problems in providing an ad-

TABLE 65
LOCAL EMPLOYMENT GENERATED BY THE MINE AND FACILITY

Year	Local Construction Employment	Local Operations Employment	Local Indirect Employment	Total Local Employment
1	250	50	200	500
2	600	50	500	1,150
3	700	100	600	1,400
4	400	100	550	1,050
5	300	200	550	1,050
6	300	200	550	1,050
7	350	200	600	1,150
8	100	250	500	750
9	0	250	450	700
10-40	0	250	450	700

NOTE: Based on assumptions detailed in table 66. Employment is rounded to the nearest 50.

TABLE 66
POPULATION IN-MIGRATION ASSOCIATED WITH THE MINE AND FACILITY

Year	Population Associated with Direct Employment		Population Associated with Indirect Employment	Total Incoming Population
	Construction[1]	Operation		
1	350	50	250	650
2	1,000	100	600	1,700
3	1,150	200	700	2,050
4	700	250	650	1,600
5	550	400	650	1,600
6	500	400	650	1,550
7	600	400	700	1,700
8	150	550	600	1,300
9	0	550	550	1,100
10-40	0	550	550	1,100

NOTE: Population is rounded to the nearest 50.

[1]There would be a 6-month lag period between direct construction and operation employment and associated indirect employment.

equate overall level of services. Additional funding, over that which would legislatively flow to the community as a result of economic development and/or population increases, would be necessary if the incoming population is to be provided with adequate public services.

LIVESTOCK GRAZING MANAGEMENT

The resource specialist identified changes in animal unit months by alternative. Animal unit months were converted to livestock sold by assuming that each head of livestock would require l2 animal unit months per year. Of the estimated 250 plus permittees affected by the management actions, only a dozen or so would be sheep operators. Changes in grazing fee receipts to the federal government were based on the l990 animal unit month value of $1.81.

The output measure for livestock grazing was the average value of livestock sold in the planning area. The average value was calculated by dividing the total value of livestock sold in the counties in the planning area in 1987 by the number of livestock sold (State of Montana, Department of Commerce, 1989). The average value was adjusted to l990 dollars using the average annual change in the implicit price deflator for gross national product. The average value per head of livestock sold in l990 dollars was $494.

OIL AND GAS

The resource specialist estimated the number of wells that would be affected for each alternative. The effect could be increased costs resulting from site relocations and delays, or in some cases, a number of wells could not be drilled. While the increased costs of relocating well sites and delays are important from an individual operator's standpoint, the increased costs were not estimated due to the small number of wells potentially affected.

In the case of the wells that could not be drilled, estimates of producing wells and dry holes were made using the Williston basin averages because exact well locations were not known. The success rate for drilling in the Williston basin was approximately one in four (27 percent).

Dry holes were valued at the 1988 average cost for wells drilled to l0,000 to l2,495 feet, average depths for the Williston basin (American Petroleum Institute 1988). The 1988 value was adjusted to l990 using the gross national product deflator. The value used for each dry hole was $625,000 dollars.

Producing wells were valued based on the average economic ultimate recovery for wells in the Williston basin region. The economic ultimate recovery for wells in the Williston basin was 290,000 barrels over an estimated 20-year life. For analysis purposes, average annual production was calculated by dividing the economic ultimate recovery by 20 years, or l4,500 barrels per year. Oil wells do not produce equal volumes over time. The rate of production is a function of initial reservoir pressures and individual well production decline curves. Because the location, timing, and producing horizons of the foregone wells could not be determined, the average is used for the analysis.

The gross output was the result of multiplying the average annual production by the number of wells lost by the average price of oil in l990 dollars. That value was used for the multiplier analysis.

Similarly, federal royalties were calculated by multiplying the average value of the products lost by the federal royalty rate, l2.5 percent. Federal rents were the number of acres closed to leasing times the weighted average annual rental rate of $l.80 per acre. The state of Montana's share of the rents and royalties is 50 percent of the total.

RECREATION

The recreation analysis focused on the activities and the sites affected by the proposed management actions and the resource allocation alternatives discussed in the resource management plan and environmental impact statement. These activities include big game, waterfowl, upland bird hunting, and fishing throughout the planning area. They include the day use activities associated with the Powder River Depot and Calypso recreation areas, Makoshika State Park, and the activities associated with development of these sites and construction of the Cherry Creek reservoir and dam.

Hunter days and harvest rates are compiled by the Montana Department of Fish, Wildlife and Parks annually for each hunting district. The 1988 data was used for the hunting districts in Regions 6 and 7 included in the planning area boundary. Lake angler days were based on the average use from 1982 to 1985 as reported in a mail survey, "Montana Statewide Angling Pressure" (State of Montana, MDFW&P 1989).

Visitor use estimates for the recreation sites came from the BLM's Recreation Management Information System and the Montana Department of Fish, Wildlife and Parks. Reservoir use estimates were based on the Bureau of Reclamation's annual wildlife and recreation summaries.

Outdoor recreation participation rates by age classes and region were found in the "Montana Outdoor Recreation

Needs Survey" by the University of Montana Forestry School. Adjustments were made based on the preliminary 1990 census data for Montana.

Estimates of nonresident highway visitors and expenditures data were found in the Institute of Tourism Research, University of Montana, April 1990 report entitled "Estimates of Economic Impact of Nonresident Travelers to Montana." The hunting and fishing expenditure data came from the following reports prepared for the Montana Department of Fish, Wildlife and Parks.

The Net Economic Value of Deer Hunting in Montana, 2/88.
The Net Economic Value of Elk Hunting in Montana, 2/88.
The Net Economic Value of Antelope Hunting in Montana, 1/88.
The Net Economic Value of Fishing in Montana, 8/87.

In order to estimate changes in visitor use of developing the recreation sites and Cherry Creek Special Recreation Management Area, the following assumptions were made. The resident visitor use for the Terry area sites, exclusive of Cherry Creek, was based on the participation rates from the 1985 Outdoor Recreation Survey and the estimated population within 1-hour's drive (55 miles).

The estimated operation and maintenance costs for the recreational facilities are $199,000 (10% of the construction costs minus estimated user fees).

Cherry Creek Reservoir

The two options considered are a 40- or a 50-foot pool maximum depth reservoirs. Each option was measured by three objectives. The reservoir must (1) sustain a fishery, (2) provide recreational use, and (3) have a useful life exceeding 50 years.

CONSTRUCTION COST ESTIMATES FOR 40-FOOT POOL DEPTH DAM

This reservoir would cover 455 acres with a maximum pool depth of 40 feet and an initial storage capacity of approximately 8,893 acre-feet. A pipeline is proposed in order to maintain a relatively constant reservoir level. The total cost for the construction of the 40-foot pool depth reservoir would be $10.8 million. This cost includes $7.9 million for construction of the dam, outlet works and spillways (see table 67); $640,000 for a 6 cubic feet-per-second capacity pumping station and a 15-inch diameter pipeline ($300,000 and $340,000 respectively); and $2.23 million for recreational developments. Estimated costs for annual operation and maintenance for the dam are $75,000 ($40,000 for labor, and $35,000 for material and equipment). The annual energy cost for pumping water is estimated at $7,900.

TABLE 67
COST SUMMARY FOR 40-FOOT POOL DEPTH EARTH-FILLED DAM

Item	Total Construction Costs
Dam	4,003,165
Outlet Works	1,316,806
Spillway	2,188,508
Grouting	357,500
River Control and Dewatering	17,875
Total	7,883,854

SOURCE: USDI, Bureau of Reclamation 1990a

The average annual evaporation and seepage loss from the reservoir would be 4,740 acre-feet with a pump, and 3,179 acre-feet without a pump. The minimum pool depth is 27 feet with a pump, and 16 feet without a pump. The minimum surface area is 309 acres with a pump, and 187 acres without a pump. A pumping station is necessary to provide a relatively constant water level for quality recreational use.

During the life of the reservoir, approximately 1,099 acre-feet of water would be pumped from the Yellowstone River annually. The pump (6 cubic feet-per-second) would run an estimated 93 days a year. A 40-year reservoir with supplemental pumping meets the stated objectives: it sustains a fishery, is large enough to provide quality recreation, and has a useable life of 77 years, exceeding the 50-year life objective. A 40-foot pool depth reservoir without supplemental pumping cannot sustain a fishery because the pool depth drops below 20 feet.

CONSTRUCTION COST ESTIMATES FOR 50-FOOT POOL DEPTH DAM

This reservoir would cover 569 acres with a maximum pool depth of 50 feet and an initial storage capacity of approximately 14,078 acre-feet. A pumping station and a pipeline would maintain a relatively constant reservoir level.

The total cost for the construction of the 50-foot pool depth reservoir would be $13 million. This cost includes $9.9 million for construction of the dam, outlet works, and spillways (see table 68); and $890,000 for a 10 cubic feet-per-second capacity pumping station, an 18-inch diameter pipeline; and $2.23 million for recreational developments. Estimated costs for annual operation and maintenance for the dam are $75,000 ($40,000 for labor, and $35,000 for material and equipment). The annual energy cost for pumping water is estimated at $16,000.

The average annual evaporation and seepage loss from the reservoir would be 6,678 acre-feet with a pump, and 3,752 acre-feet without a pump. The minimum pool depth is 32 feet with a pump, and 16 feet without a pump. The minimum surface area is 372 acres with a pump, and 190 acres without a pump.

TABLE 68
COST SUMMARY FOR 50-FOOT POOL DEPTH EARTH-FILLED DAM

Item	Total Construction Costs
Dam	5,228,740
Outlet	1,612,873
Spillway	2,723,477
Grouting	357,500
River Control and Dewatering	17,875
Total	9,940,465

SOURCE: USDI, Bureau of Reclamation 1990a

A pumping station is necessary to provide constant water levels for quality recreation. During the life of the reservoir, approximately 2,265 acre-feet of water would be pumped from the Yellowstone River annually. The pump (10 cubic feet-per-second) would run an estimated 114 days a year.

A 50-foot pool depth reservoir with supplemental pumping meets the stated objectives: it sustains a fishery, is large enough to provide quality recreation, and has a useable life of 136 years, exceeding the 50-year life objective. A 50-foot pool depth reservoir without supplemental pumping cannot sustain a fishery because the pool depth drops below 20 feet.

ANNUAL COST ESTIMATES

The annual reservoir costs for each reservoir is the sum of the total capital costs, including energy costs, amortized over the life of each reservoir plus the annual operation and maintenance costs.

TABLE 69
ANNUAL RESERVOIR COSTS

Reservoir Pool Depth	Capital Cost	Operations & Maintenance Costs	Total Annual Cost
40-foot	896,976	265,000	1,161,967
50-foot	1,092,965	265,000	1,357,965

VISITOR USE AND ECONOMIC BENEFITS

The benefits from recreation projects are figured from an estimated annual number of visitors and the economic values placed on those visits. The estimated number of visitors for the Cherry Creek Special Recreation Management Area is based on a comparison of similar reservoir sites in Montana. The Bureau of Reclamation's Montana Projects Office prepares an annual recreation and wildlife summary for each reservoir it manages in Montana. This summary includes visitor use estimates, a list of facilities, and the types of activities available. Upon review of that summary data the Tiber Reservoir which is southeast of Shelby, the Fresno Reservoir which is northwest of Havre, the Nelson Reservoir which is northeast of Malta, and the Intake Diversion Dam which is northeast of Glendive were used for comparison.

In order to calculate visitor use per thousand population, an area of origin was defined for each reservoir. These areas are within a 2-hour (100-mile) driving radius with the dams at the center of the circle. The visitor population has two components: total county population, and the number of fishing licenses sold in those counties within a 2-hour driving radius of each reservoir. The visitor population is the average of 1980 and 1988 populations of those counties entirely or partially within the circle. County populations were adjusted to reflect highway access, proximity to similar recreational facilities, and physical barriers such as the Fort Peck Reservoir. The second component of the visitor population is the average number of nonresident fishing licenses compared to resident fishing licenses sold in these counties in 1980, 1985, and 1988. The fishing license numbers are multiplied by the ratio of lake angler days to total angler days for each Montana Department of Fish, Wildlife and Parks region.

The counties within the 2-hour driving radius are placed into three categories. For those counties immediately adjacent to the reservoir, the visitor population equals the total population plus the nonresident fishing licenses sold. The second category includes counties with access to similar recreation areas. The visitor population is defined as a portion of the total population in addition to nonresident fishing licenses sold. The third category includes counties in the 2-hour driving radius with access to similar recreation facilities. The visitor population of these counties equals the number of resident fishing licenses sold. Table 70 shows the estimated visitor use per thousand population for the four selected reservoirs.

TABLE 70
ESTIMATED VISITOR USE
PER 1,000 POPULATION

Population	Average Number Of Visits	Average Visitor Population	Visits Per 1,000
Fresno	32,985	48,793	676
Intake	32,736	43,297	756
Nelson	21,977	25,299	869
Tiber	37,697	55,689	677

SOURCE: USDI, BLM 1991a.

The estimated visitor population at the Cherry Creek Reservoir is approximately 33,455.

TABLE 71
ESTIMATED VISITOR POPULATION

County	Population[1] 1990	Fishing Licenses[2] Resident	Nonresident
Custer	11,697	-	167
Fallon	3,103	-	25
Prairie	1,383	-	8
Dawson[3]	4,753	185	565
Golden Valley, ND[3]	1,172	-	-
Garfield[3]	795	19	23
McCone[3]	1,138	44	18
Rosebud[3]	5,253	144	150
Wibaux[3]	596	11	48
Carter	-	48	-
Powder River	-	96	-
Richland	-	1,200	-
Roosevelt	-	775	-
Treasure	-	39	-
Total	29,890	2,561	1,004

SOURCE: Montana State Office unpublished visitor files.

[1]State of Montana, Department of Commerce 1991.
[2]Average number of fishing licenses sold in 1980, 1985 and 1988 multiplied by the ratio of lake angler days to the total angler days (1982-1985) for Montana Department of Fish, Wildlife and Parks Regions 6 and 7.
[3]One-half of the population use is due to the proximity of similar recreational facilities.

Using the average 745 visits per thousand (see table 70), the projected annual visits for Cherry Creek Reservoir would be approximately 25,000. The visitor use estimates represent the total for this site. Some are people who otherwise would visit other reservoirs if this one were not built. The remainder are people who would not use any other reservoir at all. Some use by interstate travelers passing through is probable but the amount of use is unpredictable.

The BLM conducted a telephone survey in March of 1991 in order to estimate the percent of use that would shift to the proposed Cherry Creek Reservoir from other reservoirs in the region (Trent 1991). Selected public land users and representatives of interest groups in eastern Montana were surveyed. While the sample size was not large enough to be totally representative for the purpose of validity, it was sufficient for estimating visitor use at this stage in the evaluation process. The survey respondents who fish regularly indicated they would increase their angler days by approximately 35 percent. They also estimated they would use the Cherry Creek Reservoir approximately 30 percent of the time if constructed.

According to the Montana Statewide Angling Preserve Mail Survey for 1982-1985 (State of Montana, MDFW&P 1989), the average number of lake angler days for Montana Department of Fish, Wildlife and Parks Region 7 was 25,000. Hypothetically, if angler days were to increase by 35 percent, and existing use transferred to Cherry Creek Reservoir, the potential number of angler days at Cherry Creek could reach a conservative annual estimate of 16,000, or as much as 65 percent of the total estimate.

Recreational activities created by federal water projects provide economic benefits measured by the visitors willingness to pay. The willingness to pay concept (the amount of money that people are willing to pay, over and above actual expenditures), is required by the U.S. Water Resources Council and is explained in the Principles and Guidelines document published in 1983. The willingness to pay values used in this analysis are shown in table 72 by type of activity.

Tables 73 and 74 show the visitor use scenarios. The first scenario for the 40-foot pool depth dam is based on the assumption that 25,000 visitor days include 40 percent fishermen, 30 percent boaters, and 30 percent nonspecific users. The second scenario for the 50-foot dam is based on the assumption that the 25,000 visitor days are representing 50 percent fishermen, 25 percent boaters, and 25 percent nonspecific users.

TABLE 72
ESTIMATED WILLINGNESS TO PAY VALUES PER VISITOR DAY

Type of Activity	Dollars per Visitor
Fishing	83
Boating (motor)	23
Bankside	10

SOURCE: State of Montana, MDFW&P 1988; USDI, BLM 1991a.

NOTE: Dollar values are adjusted to 1990, using the implicit price deflator for the gross national product.

TABLE 73
ANNUAL VISITOR USE
40-FOOT POOL DEPTH DAM

Activity	Visitor Days	Willingness to Pay
Fishing	10,000	$ 830,000
Boating	7,500	172,500
Other	7,500	75,000
Total	25,000	$1,077,500

TABLE 74
ANNUAL VISITOR USE
50-FOOT POOL DEPTH DAM

Activity	Visitor Days	Willingness to Pay
Fishing	12,500	$1,037,500
Boating	6,250	143,750
Other	6,250	62,500
Total	25,000	$1,243,750